City of Salina

GUIDELINES FOR WIRING SINGLE FAMILY DWELLING UNITS

This guideline has been prepared to assist the lay person comply with the requirements of the National Electrical Code (NEC) and assure the installation of a safe and reliable electrical system. This guideline is NOT inclusive for every installation.

An electrical permit is required **(Salina Municipal Code Sec. 8-146)** to install any wiring for transmitting electrical current to provide light, heat or power, or to make a change or addition to any such wiring. A permit is not required to replace an outlet, a switch or other minor electrical devices, such as lights.

A licensed electrical contractor must perform any work which requires a permit, except the owner/occupant of a single family residence can perform work on the residence with the proper permits and inspections.

1. SERVICE

The service equipment must be large enough to supply the connected load which is calculated using Article 220 of the NEC. The most common sizes of residential service equipment are 100, 125, 150, 175, and 200 amperes. The minimum wire size for service entrance conductors are listed in the following table:

THREE WIRE, SINGLE PHASE DWELLING SERVICES
Conductor Types and Sizes
RH-RHH-RHW-THHW-THW-THWN-THHN-XHHW-USE

Type "USE" (Underground Service Entrance) conductors are not permitted to enter a building unless they are triple rated with the additional markings RHH and RHW.

COPPER	ALUMINUM AND COPPER-CLAD AL	SERVICE RATING IN AMPS
AWG	AWG	
4	2	100
3	1	110
2	1/0	125
1	2/0	150
1/0	3/0	175
2/0	4/0	200
3/0	250 kcmil	225
4/0	300 kcmil	250
250 kcmil	350 kcmil	300
350 kcmil	500 kcmil	350
400 kcmil	600 kcmil	400

The service equipment must be grounded in accordance with Article 250 of the NEC, which, in general, says that the neutral must be bonded to the service enclosure and the grounding electrode system defined in Article 250-94 NEC.

The main service equipment panel shall be mounted either outside or inside the dwelling, as near as possible to the point of entrance of the service conductors to the building. **Salina Municipal Code 8-153 - States "if the service disconnect is to be located inside of a building or structure, the maximum length of conductors between the meter and the disconnect shall be limited to 10 feet"**. All service equipment and electrical panels shall have a clear area 30" wide (or the width of the panel, whichever is greater) and 36" deep in front. This clear area must extend from floor to ceiling with no intrusions from other equipment, cabinets, counters, appliances, etc. Panels are NOT allowed in clothes closets or bathrooms.

In the main service equipment, the neutral (white) and equipment-grounding conductors (green or bare) are bonded together; in sub-panels the neutral is isolated from ground, (the bonding screw removed and equipment grounding bar installed according manufacturer specifications).

2. BRANCH CIRCUIT WIRING

Type NM cable (AKA romex) is the wiring method most universally used in residential dwellings. NM cable must have a 90 degree conductor insulation rating, which is designated on the cable sheath by a "B", Type NM-B #12 and #14 is used for lighting and general purpose receptacle circuits, while #10/2 w/ground is commonly used for electric water heaters, #10/3 w/ground for electric dryers, and #8/3 w/ground and #6/3 w/ground for ranges and wall mounted ovens. Type "SER" cable with an insulated neutral is permitted for electrical ranges, wall ovens and dryers.

These cables must be protected by over-current devices (circuit breakers) which do not exceed the cables rated ampacity. The rated ampacities for cable types are listed below:

COPPER NM CABLE	TYPE S.E. and S.E.R. ALUMINUM CABLE
15 amperes for #14	40 amperes for #8
20 amperes for #12	50 amperes for #6
30 amperes for #10	
40 amperes for #8	
50 amperes for #6	

Note: Any receptacles installed on a branch circuit shall be appropriately sized for the conductor and the branch circuit protection (breaker).
The exception is a 15 amp duplex receptacle may be installed on any 15 amp or 20 amp general purpose branch circuit (i.e. not a dedicated circuit). This exception also applies to 15 amp GFCI duplex receptacles.


Standard 15 amp duplex receptacle.

All wiring splices must be made in junction boxes. An outlet, switch or light box may be used as a junction box. All junction boxes must have covers and be accessible. Type NM cable must be stapled within 12 inches of metal boxes, 8 inches of plastic boxes and every 4 1/2 feet thereafter. Proper connectors must be used where NM cable enters metal cabinets, boxes or panel boards.

When Type NM cable is installed parallel to framing members, or in bored holes, it shall be located at least 1 1/4 inches from the nearest edge of the framing member, where nails or screws may penetrate the cables. If this distance cannot be maintained, the cable shall be protected by a steel plate or sleeve at least 1/16 inch thick.

Cable or raceway-type wiring methods installed in a groove, to be covered by wallboard, siding, paneling, carpeting, or similar finish, shall be protected by 1/16 inch steel plate, sleeve, or equivalent, or must be recessed in the groove 1 1/4 inch for the full length of the groove in which the cable or raceway is installed. Exception: Raceways as covered in articles 345, 346, 347 and 348. Section 300-4(e) NEC.

Ceiling mounted paddle fans weighing 35 pounds or less, may be supported by outlet boxes identified for such use. Fans weighing more than 35 pounds must be supported independently of the box.

3. REQUIRED BRANCH CIRCUITS

A. Small Appliance Branch Circuits – The NEC requires a minimum of two 20 ampere branch circuits to feed receptacle outlets for small appliance loads, including refrigeration equipment in the kitchen, pantry, breakfast room, and dining room. These circuits, whether two or more are used, shall NOT supply anything other than receptacles in these areas. Lighting outlets and built-in appliances such as garbage disposals, hood fans, dishwashers, and trash compactors are NOT permitted on these circuits. Kitchen counter top receptacles must be supplied by at least two small appliance branch circuits.

B. Laundry Branch Circuit – One 20-amp branch circuit must be provided for the laundry room. No other outlets are permitted on this circuit.

C. Bathroom Receptacles – At least one 20 amp circuit for bathroom receptacle outlets shall be supplied, such circuits may have no other outlets. However, if the dedicated circuit serves only one bathroom, other openings in the bathroom may be served by that circuit.

D. Central Heat – Central heating equipment shall be supplied by an individual branch circuit.

E. General Purpose Circuits – With the exception of (a) through (d) above, lights and outlets may be mixed in any combination on 15 and 20 amp circuits. However, we recommend the total number of lights and outlets on any 15-amp circuit not exceed 10 and the total number of lights and outlets on any 20-amp circuit not exceed 13.

4. REQUIRED RECEPTACLE OUTLETS

Note: See Section 6 on page 4 of this document for the GFCI requirements for Sections A-F listed below.

A. At least one adjacent to each basin in every bathroom.

B. At least one in every attached garage, and one in every detached garage with electric power.

C. At least two installed outdoors, one on the front and one on the back of the dwelling, accessible at grade level.

D. At least one receptacle must be installed in each unfinished basement. This receptacle is in addition to any that may be installed for laundry or other specific purposes.

E. In every kitchen, family room, dining room, living room, parlor, library, den, sun room, bedroom, recreation room or similar room, or area of dwelling units, receptacle outlets shall be installed so that no point along the floor line in any wall space is more than six feet measured horizontally, from an outlet in that space, including any wall space, two feet or more in width, and excluding only that space occupied by sliding panels in exterior walls. The wall space afforded by fixed room dividers, such as freestanding bar-type counters, or railings, shall be included in the six foot measurement. No outlets may be installed over an electric baseboard heater.

F. In kitchens and dining areas, a receptacle outlet shall be installed at each counter space wider than 1 inch. Countertop receptacles shall be installed so that no point along the wall line is more than 24 inches measured horizontally from a receptacle outlet in that space. Peninsular bars and islands 1inches or wider shall have at least one receptacle.

G. Receptacles installed in the floor must use a box-receptacle combination designed specifically for that purpose. Receptacles installed in the floor within 18 inches of the wall may be used in place of wall mounted receptacles.

H. A receptacle outlet is required in any dwelling unit hallway that is ten feet or more in length.

I. At least one 15 or 20 ampere, 125 volt GFCI protected receptacle must be installed at an indoor spa or hot tub location, not closer than five feet from the inside wall of the unit and not more than ten feet away from it. Light fixtures, outlets and ceiling fans over spas and hot tubs shall be a minimum of 7 feet 6 inches above the maximum water level. Outdoors spa or hot tubs have the same requirements as a swimming pool. Overhead electrical lines may not pass over the swimming pool or the area measured 10 feet horizontally form the inside edge of the pool. Clearance of 22 feet in any direction to the water level, edge of water surface, base of diving platform, or permanently anchored raft, a clearance of 14 feet in any direction to the diving platform or tower is required.

5. REQUIRED LIGHTING OUTLETS

A. At least one wall switch-controlled lighting outlet shall be installed in every habitable room, in bathrooms, hallways, stairways, attached garages, detached garages with electric power, and at outdoor entrances or exits. The lighting outlet for interior stairways shall have a wall switch at each floor level where the difference between floor levels is six steps or more.

B. At least one wall switch controlled lighting outlet shall be installed in an attic, under-floor space, utility room, and basement, where these spaces are used for storage or contain equipment requiring servicing. The switch shall be located at the point of entry to these areas, and the lighting outlet located at or near the equipment requiring servicing.

6. GROUND FAULT PROTECTION

All receptacles listed below must be protected by a ground fault circuit interrupter:

A. Bathroom receptacles.

B. All outdoor receptacles.

C. Garage receptacles except those not readily accessible such as ceiling mounted receptacles or single receptacles in dedicated spaces for appliances.

D. Kitchen receptacles that serve counter top surfaces.

E. Counter top receptacles within 6 feet of a wet bar sink.

F. All receptacles in an unfinished basement or crawl space at or below grade, with these exceptions:
   1. Single receptacle within a dedicated location and identified for specific use by a cord and plug connected appliance.
   2. Single receptacle serving a permanently installed sump pump.

G. Hydromassage bath tubs.

H. Spas and Hot tubs and associated electrical components.

7. REQUIRED DISCONNECTING MEANS

Disconnects are required in sight of the following equipment:

A. Well pump controllers.

B. Central heating equipment (furnaces, boilers).

C. A/C condensers

D. Spas and hot tubs. Disconnecting means may be provided by cord and plug.

E. Hydromassage bath tubs. Disconnecting means may be provided by cord and plug.

F. Appliances that contain motors, dishwashers, garbage disposals, etc., disconnecting means may be provided by cord and plug.

8. CONDUCTOR FILL

Outlet and junction boxes shall be of sufficient size to provide free space for all conductors and devices enclosed in the box. All outlet boxes have a specific volume, measured in cubic inches. For example, if you had two #12/2, with ground NM-B cables entering a box with one duplex receptacle, you would need a box with a minimum volume of 15.75 cubic inches. Each #12 that enters the box needs 2.25 cubic inches with the exception of the grounding conductor which requires one 2.25 cubic inch for all of the grounds. Also, each strap containing one or more devices is counted as the equivalent of two conductors; therefore, 2.25 x 7 = 15.75.

VOLUME REQUIRED PER CONDUCTOR

#14 - 2 cubic inches
#12 - 2.25 cubic inches
#10 - 2.5 cubic inches
#8 - 3 cubic inches
#6 - 5 cubic inches

9. EQUIPMENT GROUNDING CONDUCTOR MAKE-UP

All equipment-grounding conductors must be connected together with solderless pressure connectors such as wire nuts or crimp sleeves, leaving sufficient extra conductor for attachment to the metal box and/or device. When crimp type connectors are used, they must be crimped using the tool recommended by the manufacturer. Please note that ALL metal junction and outlet boxes must be grounded by attaching the equipment grounding conductor out of the NM cable to the metal box using an approved screw or grounding clip. When circuit conductors are made up, **six** inches of free conductor measured from the front of the box must be left for use in make-up and for the attachment of devices.

10. ELECTRIC HEAT CIRCUITRY

Electric heat may be installed on 15, 20 or 30 amp branch circuits. Listed below is the maximum wattage that may be installed on each size branch circuit. (All circuits are figured at 240 v)

15A - 2,880 watts maximum
20A - 3,840 watts maximum
30A - 5,760 watts maximum

For example, if you are installing baseboard heaters, which are rated 250 watts, a linear foot, you could install 15' on a 20 amp, 240-volt circuit. 250w x 15 =3,750 watts.

11. ROUGH-IN INSPECTION

At the time you call for your rough-in inspection, you should have all wire pulled, stapled properly, and all splices made up and ready to accept devices and fixtures. Please DO NOT install any devices or fixtures or cover any wiring with insulation or wall coverings, i.e., drywall or paneling.

12. FINAL INSPECTION

The electrical installation should be complete at the time of request. All devices and fixtures installed, service equipment completed, and labeled properly. All wiring shall be free from short circuits, ground faults and open circuits. All light fixtures are required to be grounded, along with light switches that are within five feet of a grounded object.

PLEASE DO NOT HESITATE TO ASK YOUR LOCAL INSPECTOR QUESTIONS.

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